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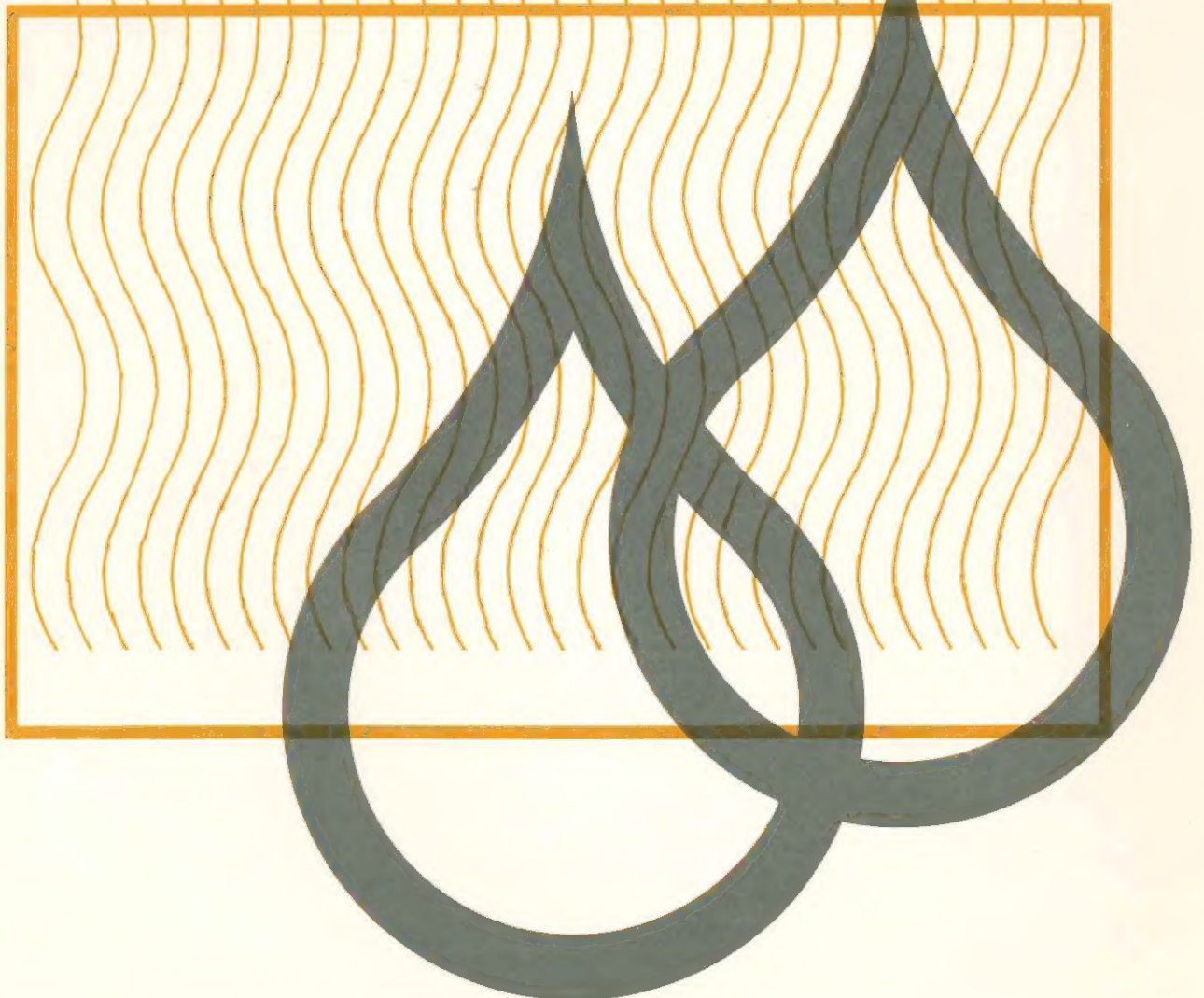
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**plate  
and  
tubular  
evaporators**



for the food, chemical, dairy and pharmaceutical industries



To provide more efficient and economical concentration of food, chemical, dairy and pharmaceutical products, APV offers a comprehensive selection of both plate and tubular evaporators.

APV evaporators are designed to meet widely varying requirements involving product viscosity, heat sensitivity, thermal characteristics, degree of concentration, and production rates. Units are available for continuous or batch, single pass or recirculation, and multiple effect or thermal recompression operations as dictated by desired product characteristics and economic factors. Experienced APV engineers also are available to render assistance in selecting the proper evaporator for any given application and to suggest, if at all possible, any improved operating techniques which may reduce processing costs.





## APV plate evaporator

### *description*

With the development of the unique plate evaporator concept, APV introduced a major breakthrough in rapid, economical concentration of heat sensitive liquids.

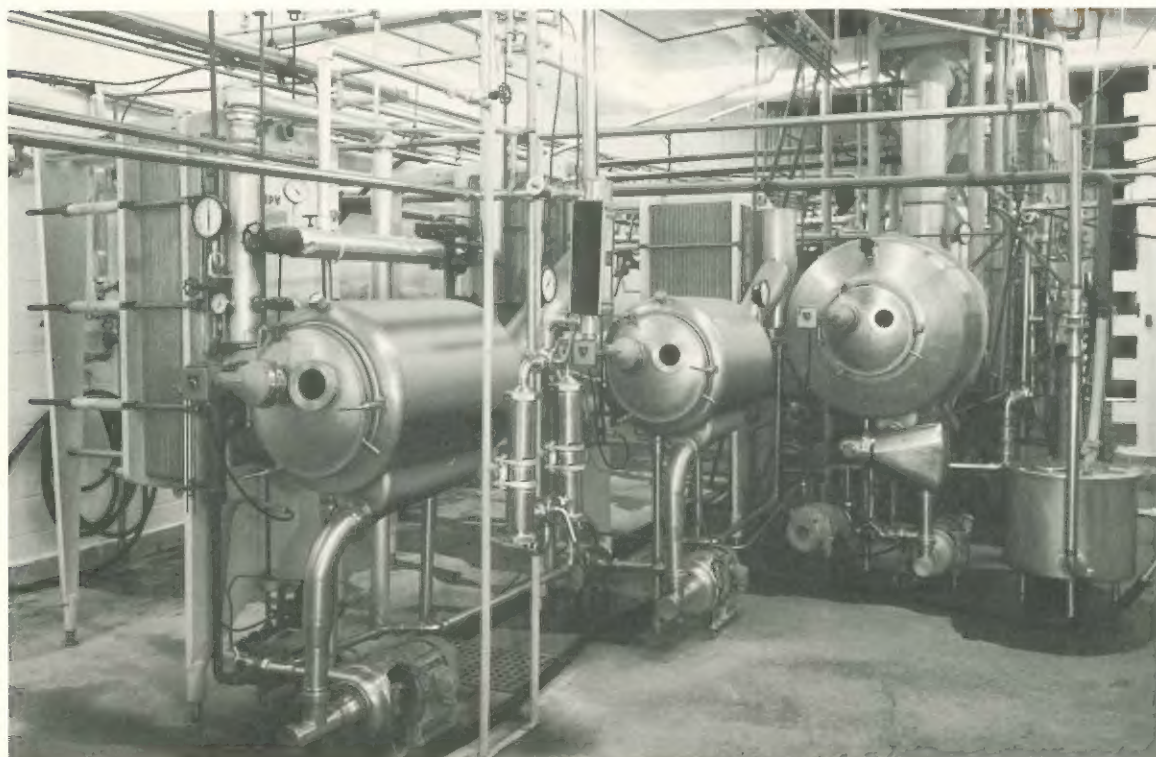
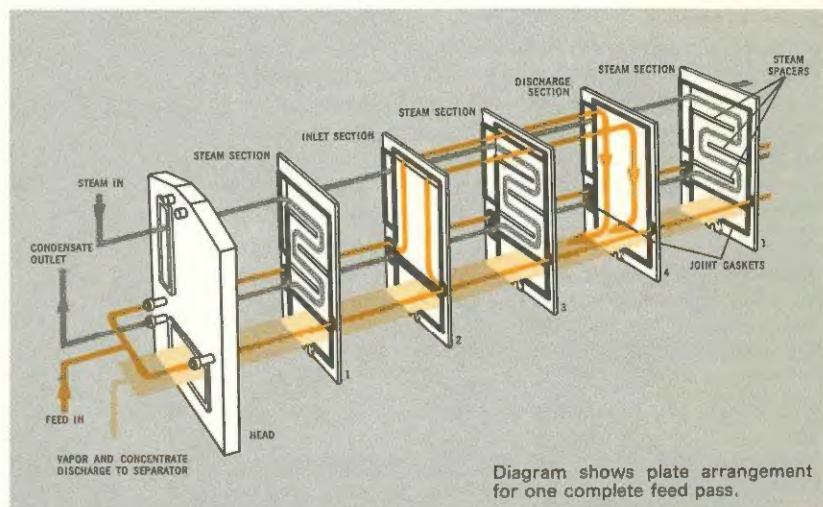
The APV plate evaporator consists of multiple gasketed plates mounted within a frame that uses minimum head room and floor space. The evaporator operates on a single pass, rising-falling film principle with plates arranged in a series of processing units. Each unit consists of a rising film, falling film, and two adjacent steam sections. As feed liquid passes simultaneously over the rising and falling film sections in each processing unit, it vaporizes on contact with the adjacent heated plates and is discharged with its vapor to a horizontally or vertically mounted cyclone type separator. Here, the product is extracted and the vapor passed to a condenser or the next effect of the evaporator.

### *advantages*

- maximum protection of flavor and quality through high heat transfer rates, low liquid holding volume, and minimum time exposure to high temperature
- fast start up and shut down
- simple plate addition or removal for quick capacity changes
- efficient in-place cleaning of stainless steel, product contact surfaces
- multiple effect units for evaporation rates to 60,000 lbs/hr
- low installation and operating costs
- can be completely erected on a single floor with 9' overhead

### *applications*

For use in concentrating heat sensitive juices, dairy products, coffee and tea extracts, soup stocks, corn syrup, dextrose, sucrose, malt extract, and certain chemicals.



Triple effect plate evaporator is used to concentrate various fruit juices to approximately 45-72% total solids.



## falling film evaporator

APV/VAN DER PLOEG TYPE

### *description*

APV offers the proven Van der Ploeg downflow falling film evaporator engineered for the concentration of many heat sensitive liquids under either industrial or sanitary operating conditions. Units combine minimum product holding time with relatively low operating temperatures to assure complete protection of product flavor and quality. Economical operation results in savings in both manpower and steam usage.

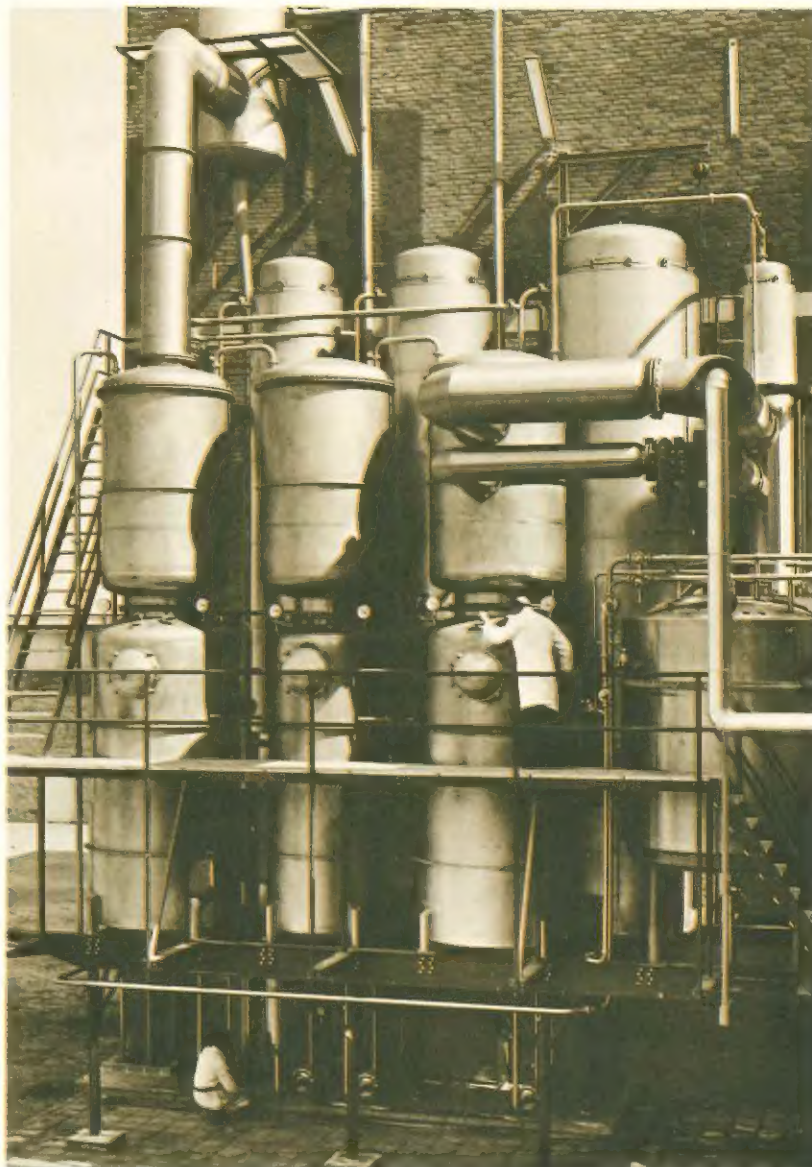
In the falling film evaporator, preheated liquid is distributed evenly to the top of vertical tubes in the first effect and flows downward with increasing velocity as evaporation occurs. The thin, uniform product film is subjected to mild heat for only a few seconds as it moves down the surfaces of the heating tubes. Vapor passes into the separator and the partially concentrated product is fed to additional effects for further evaporation.

### *advantages*

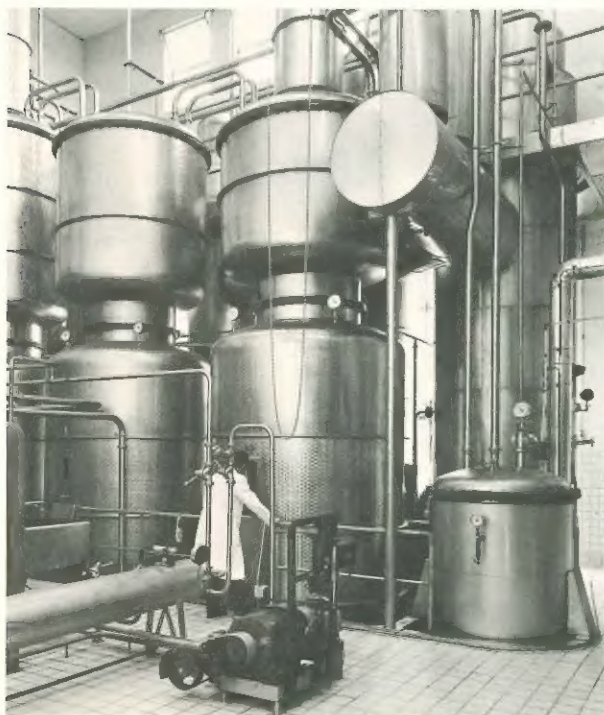
- all equipment in contact with the product is of industrial or stainless steel sanitary construction
- available in single through quintuple effects
- low steam and cooling water consumption
- CIP cleaning for reduced clean-up time and cost
- evaporators furnished complete with supporting structure and all necessary pumps, piping and heaters

### *applications*

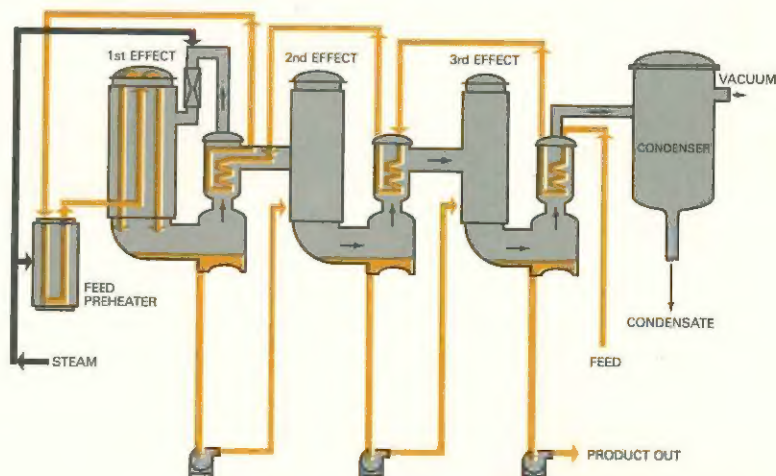
For high capacity duties in concentrating heat sensitive juices, dairy products, coffee and tea extracts, soup stocks, corn syrup, dextrose, sucrose and malt extract.



Typical three stage falling film evaporator for the concentration of heat sensitive liquids under sanitary conditions.



Triple effect falling film evaporator economically produces high quality dairy product concentrates.





## forced circulation evaporator

APV/KESTNER TYPE

### *description*

Combining mechanically produced high liquor velocities with a hydrostatic head above the tubes to prevent boiling, the APV forced circulation evaporator is engineered specifically for the concentration of liquids which tend to crystallize or produce scale.

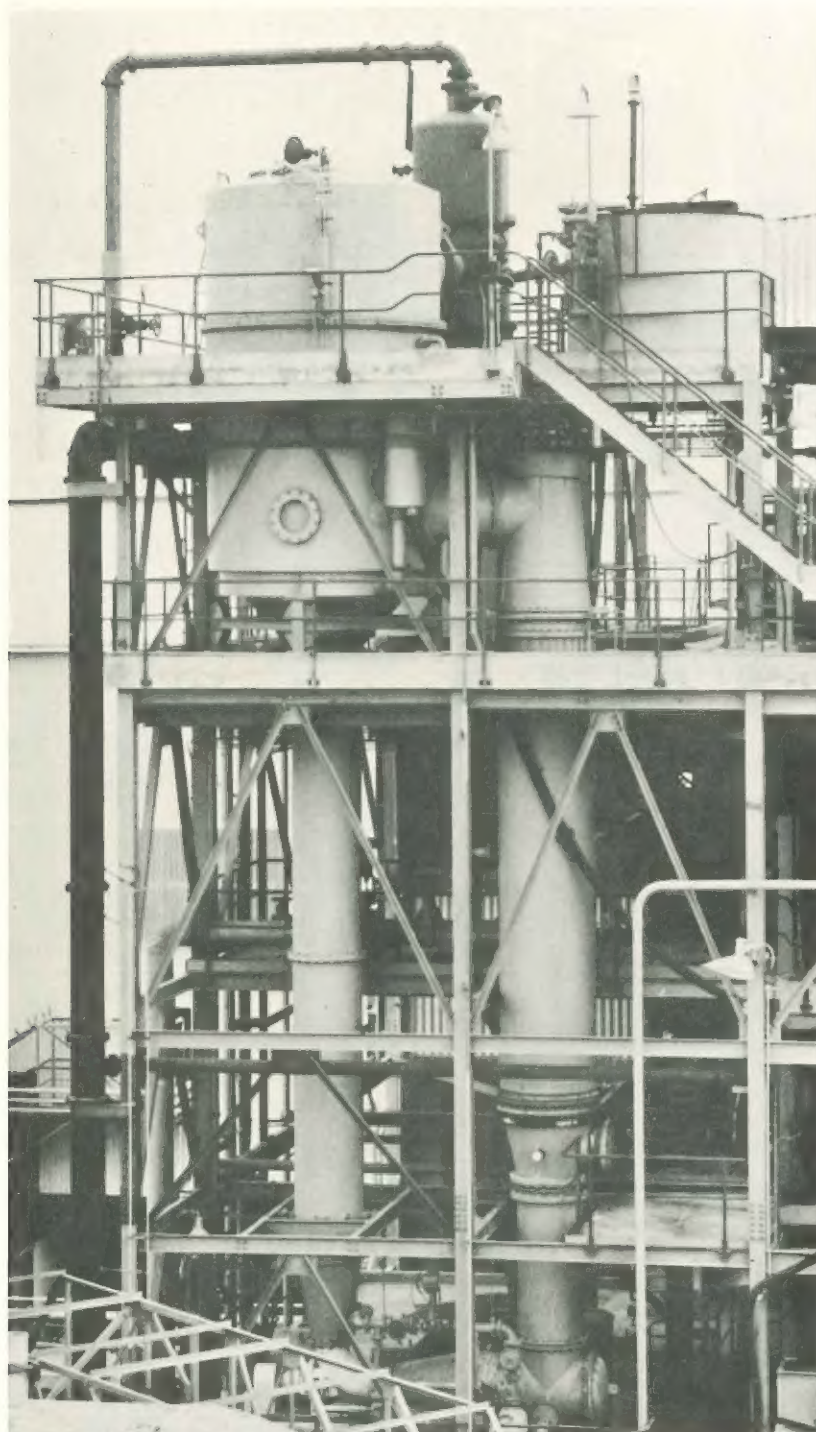
In general, this FC evaporator of Kestner design employs a high efficiency, large volume circulating pump to force liquid at controlled velocity through the evaporator tubes. Steam is admitted and the heated liquor discharged into the separator where the temperature difference causes the vapor to flash off. Since there is no boiling within the tubes, fouling on hot tube walls is reduced. Vapor is removed from the top of the separator and the concentrated liquor from the conical base. As required by product characteristics, APV forced circulation evaporators may be equipped with either vertical or horizontal steam-chests.

### *advantages*

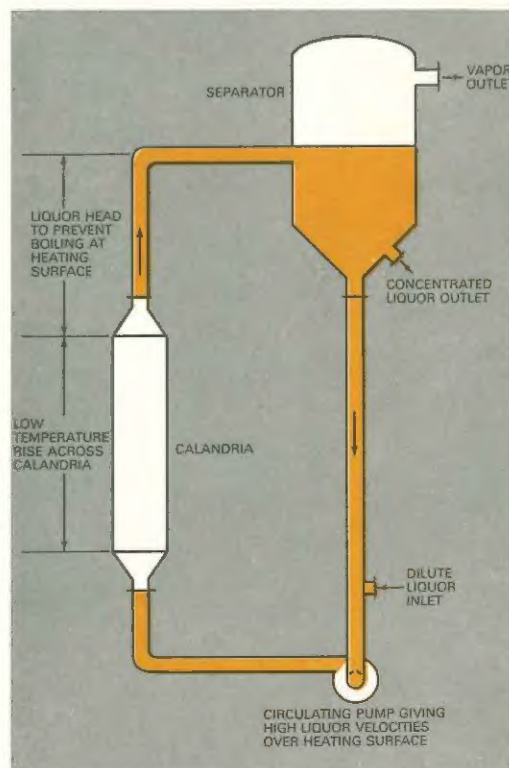
- operates with extremely low temperature rise
- manufactured in single or multiple effects
- high liquor velocities mechanically produced
- static head and high velocities prevent boiling in the tube, reduce or eliminate fouling
- available in corrosion-resistant materials of construction

### *applications*

For use in concentrating very viscous liquids, those which produce crystals or scales, and thermally degradable materials such as sulphates, sodium chloride, caustic soda, distillery waste, and fish solubles.



Single effect forced circulation unit concentrates phosphoric acid from 30 to 45%  $P_2O_5$  at a rate of 100 tons/day.





## climbing film evaporator

APV/KESTNER TYPE

### *description*

The APV long tube climbing film evaporator is recommended for the concentration of moderately heat sensitive, non-viscous and non-crystal forming liquids.

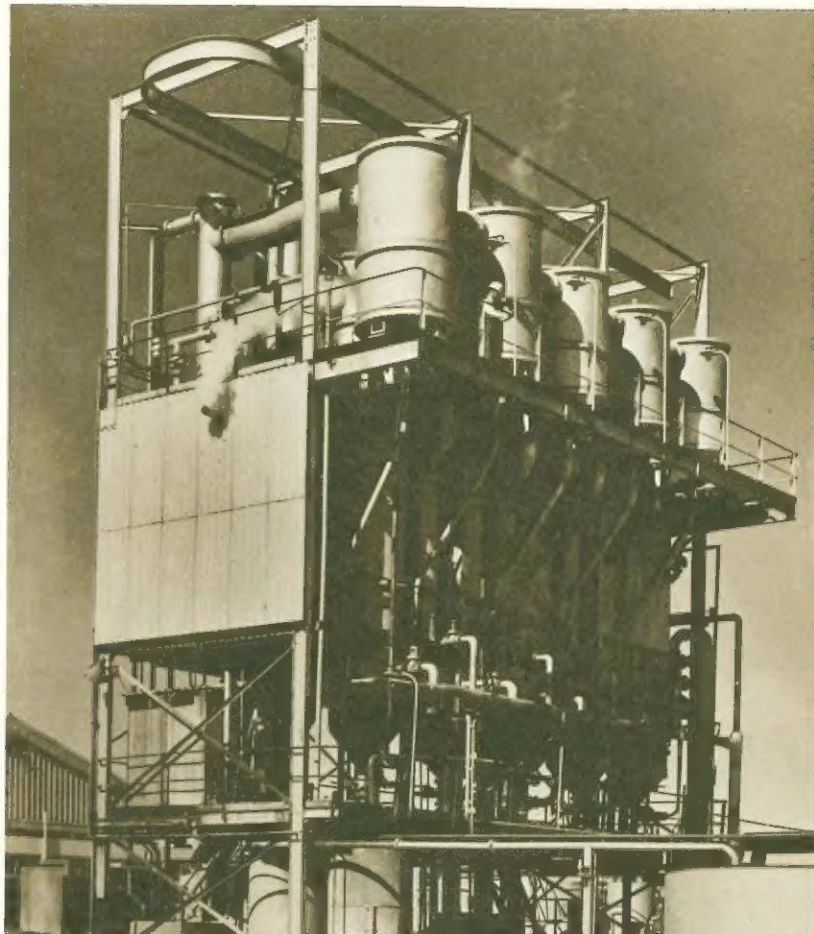
Engineered by Kestner to provide high rates of evaporation and maximum recovery of solids, this APV unit operates with natural circulation or "thermosiphon action" caused by the thermal difference between the heating medium and the liquid being concentrated. Operation is extremely simple. As pre-heated dilute liquor is brought to the boiling point in the bottom of the tubes, released vapor expands and increases in volume. This vapor rises at high velocity, causing a thin film of liquor to move up the inside wall of the tubes to the separator. Concentrated liquor is removed from the bottom of the separator as finished product or as feed for another effect.

### *advantages*

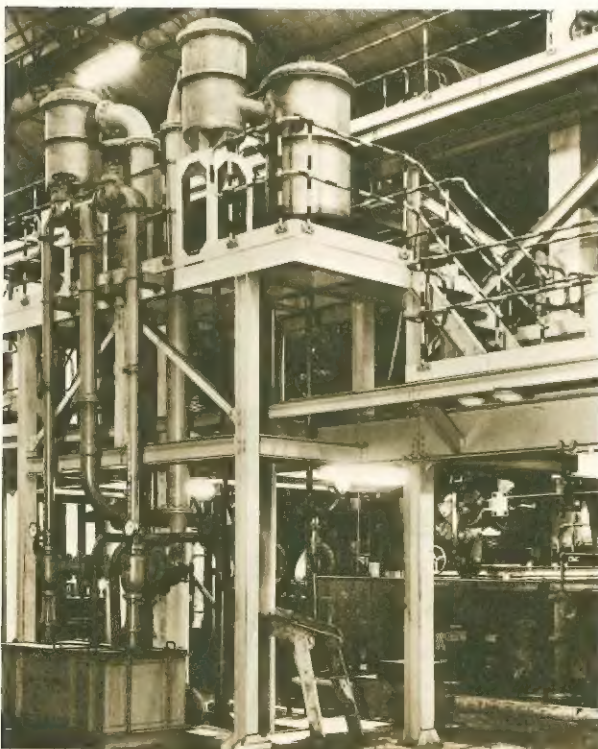
- continuous, single pass operation with low retention time
- high tube velocity gives high heat transfer coefficients
- where low temperatures and high steam economy are desired, thermo- or mechanical recompression of vapor may be used
- easy accessibility provides simple maintenance and cleaning
- single or multiple effect units available

### *applications*

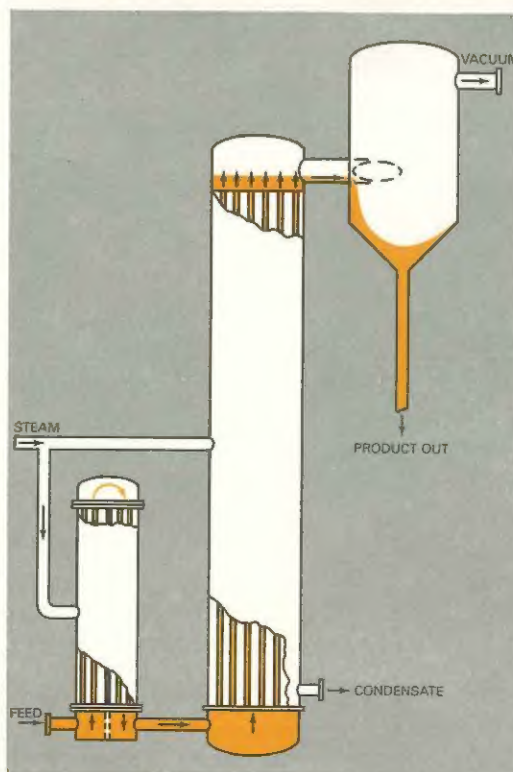
For use in concentrating thin liquids of moderate heat sensitivity. Applications include caustic soda, nitrates, spin bath liquors, sweet water glycerine, electrolytic tinning liquors, beef extract, and cheese whey.



Sodium chloride brine is concentrated in a quintuple climbing film evaporator employing forced circulation and a finisher.



Two single effect climbing film evaporators fabricated in monel are used to process an electrolytic tinning liquor.





## falling film evaporator

APV/KESTNER TYPE

### *description*

Reflecting Kestner's many years of experience in designing equipment for the CPI, this falling film evaporator is offered primarily for the concentration of a wide range of chemical and pharmaceutical products.

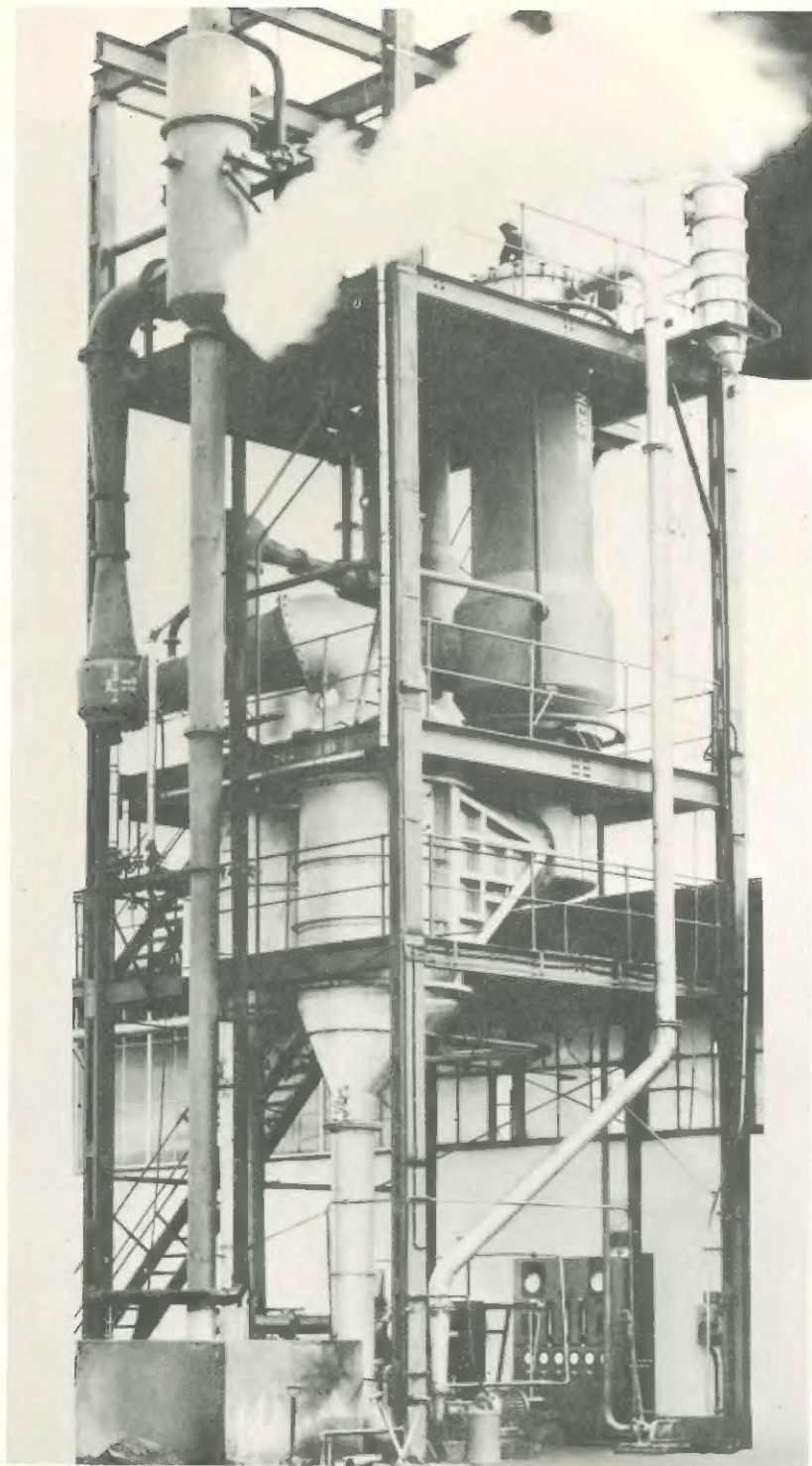
As is common to falling film units, dilute feed liquor introduced at the top of vertical tubes is partially vaporized during passage down the inside surfaces of the tubes. Since the liquid-vapor mixture flows at increasing velocity in the form of a thin, uniformly distributed film, the product is exposed to mild heat for only a very brief period of time before it passes to the separator. This operation makes the APV falling film evaporator particularly applicable to heat sensitive liquids, those too viscous for natural circulation units, or for duties where very close control of the final concentration is required.

### *advantages*

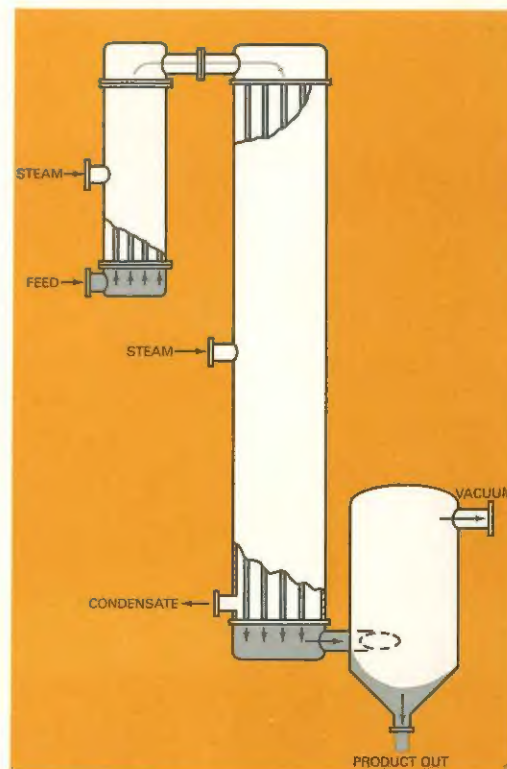
- suitable for multiple effect operation with high steam economy
- low power requirements
- simplicity of construction permits economical use of corrosion-resistant materials
- vaporizes viscous materials more readily than other types of evaporators
- can be used to advantage with thermal recompression
- special design available with contra flow hot air sweep for high concentration

### *applications*

For use in concentrating moderately viscous heat sensitive chemical products requiring low retention time and limited temperature differences. Air swept unit permits extremely high concentrations such as ammonium nitrate to 99.8%.



A heat sensitive chemical product is concentrated in a single falling film evaporator.





## climbing-falling film evaporator

APV/KESTNER TYPE

### *description*

The APV climbing-falling film evaporator is used when a very high percentage of evaporation is required and the concentrated liquor tends to be viscous.

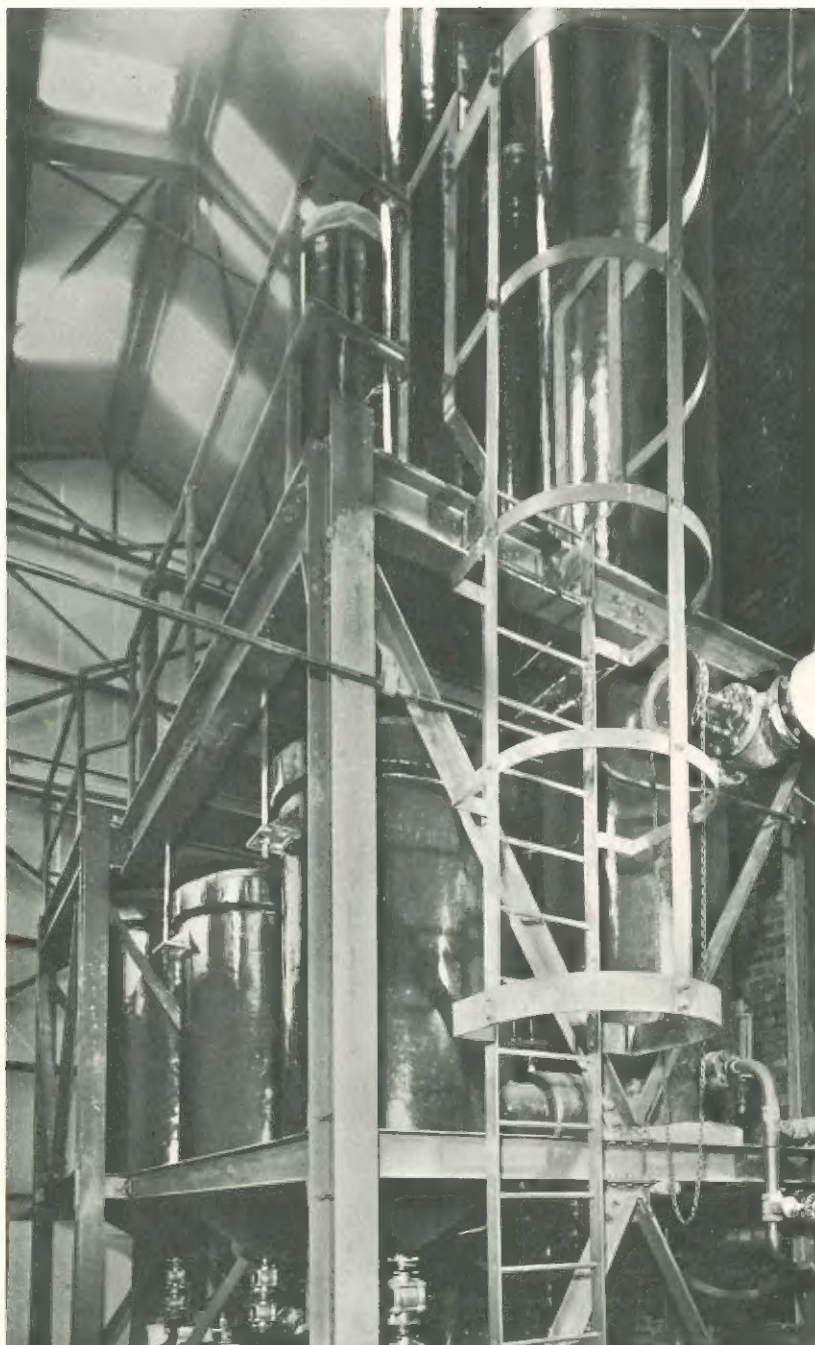
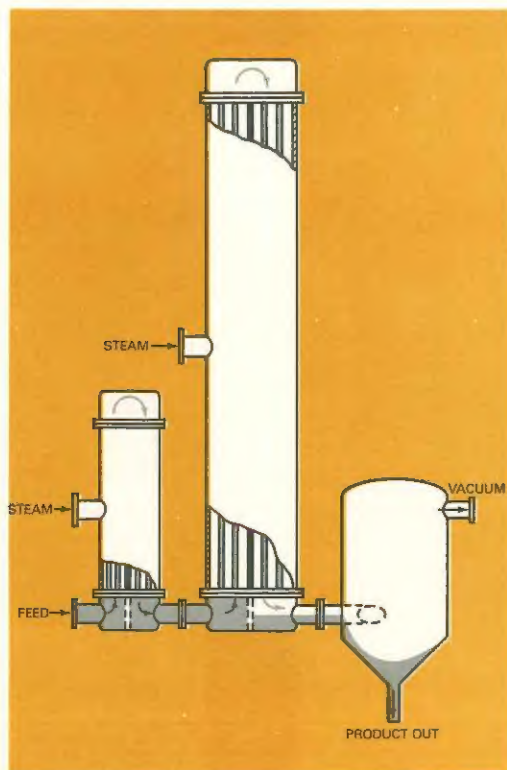
This APV high velocity evaporator is patterned after a Kestner design which divides the steamchest into two series of tubes. Preheated dilute liquid is fed to the bottom of the steamchest, passes with increasing velocity up one set of tubes, and returns down the second set as a falling film. The mixture then enters the separator where the concentrated liquor is discharged as a finished product or transferred to the next effect. Since most of the concentration occurs when the product film is falling, the unit is very suitable for handling viscous materials. The evaporator operates as a single pass unit, and product quality is preserved through minimum holding volume and short retention time.

### *advantages*

- suitable for evaporation of a wide range of liquid concentrations
- holding time is a matter of seconds
- uniform product distribution and high coefficients of heat transfer
- requires minimum head room and support structure
- available as modified S type unit with dual climbing-falling film arrangement for use with very viscous concentrates

### *applications*

For use in concentrating foamy or heat sensitive liquids requiring minimum processing time—juices, sugars, gelatin, coffee and tea extracts, ammonium nitrate, urea, and heat sensitive pharmaceuticals.



Typical climbing-falling film evaporator used for the production of caustic soda.



## falling film evaporator

APV/ROSENBLAD TYPE

### *description*

Designed primarily for large volume evaporation duties at low cost, this APV falling film evaporator incorporates a unique modular concept developed by Rosenblad engineers.

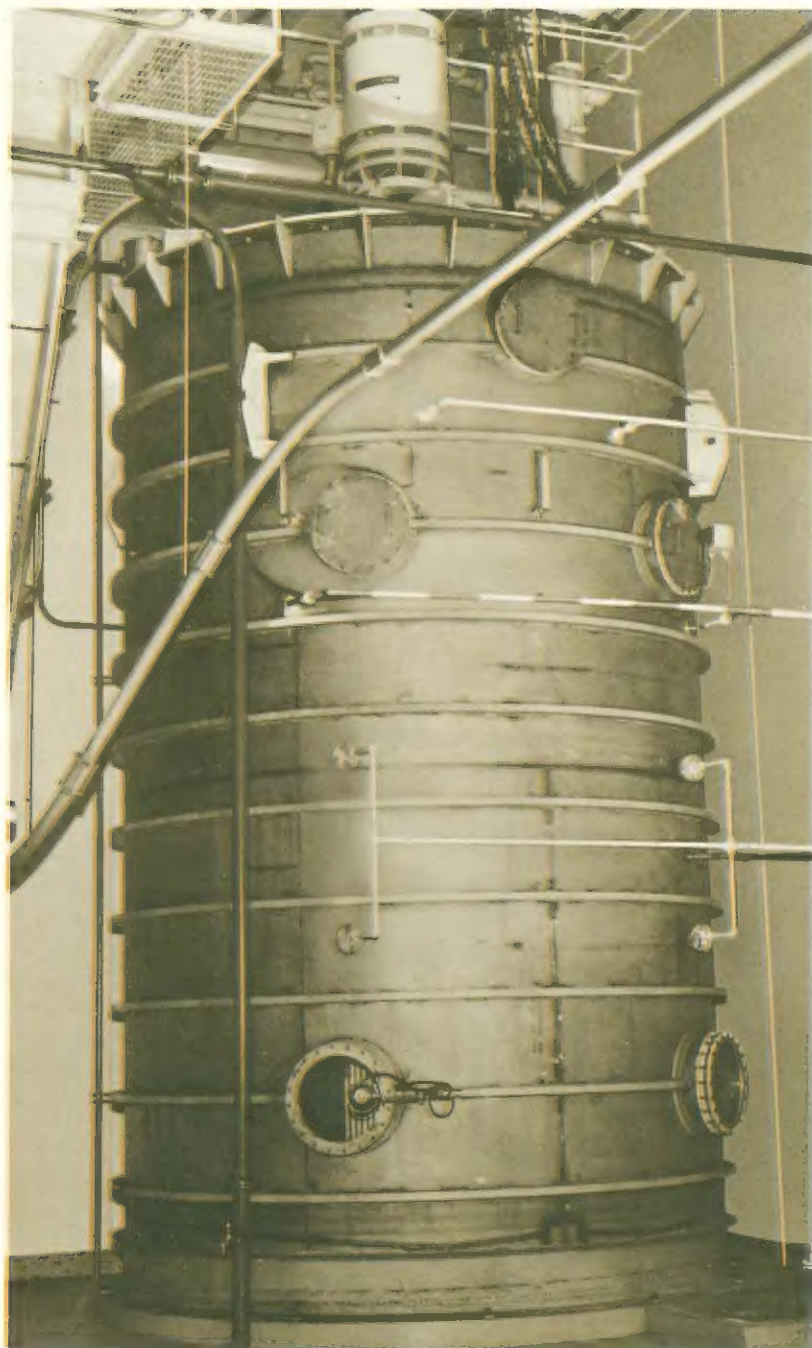
Basically, each self-contained module combines heat transfer surface and liquor-vapor separation space in a single, 12' diameter vessel. Feed liquor is distributed to flow as a film down the surfaces of flat, hollow heat transfer elements closely spaced in a pack. Evaporation occurs during this downward flow of the thin product film and concentrate is collected in a bottom sump for recirculation or discharge to another stage. During the process, released vapor travels horizontally at low velocity with zero entrainment into vapor collectors on either side of the module. Residence time is minimal and scaling is reduced by low temperature differences.

### *advantages*

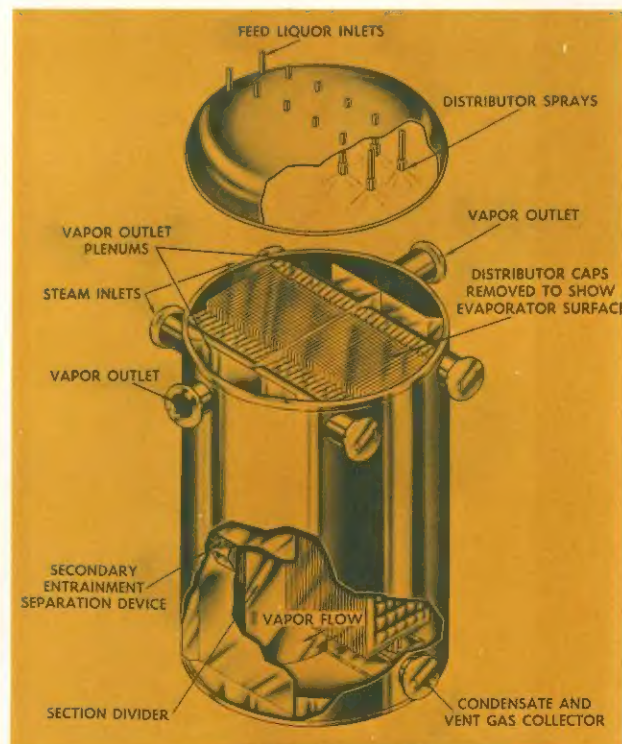
- virtually no limit in evaporative capacity
- low capital cost and remarkable economy of operation
- design completely compatible with the use of mechanical recompression which requires no steam or cooling water and gives the equivalent efficiency of up to 30 effects
- large heat transfer surfaces—high heat transfer rates
- use of spare surface sections enables heat transfer surfaces to be cleaned while operating
- requires minimum fuel per pound of evaporation

### *applications*

For use in the high volume concentration of sugar solutions, fish stickwater, and fouling liquors from the pharmaceutical, brewing and chemical industries. Also can be used as a low temperature evaporator for heat sensitive products such as blood and enzymes.



Self-contained evaporator module concentrates hog's blood from 16 to 46% total solids.



Cutaway view showing operation of evaporator module.



## APV Paravap evaporator

### *description*

The APV Paravap has been especially developed for concentrating foaming liquids or those with high viscosity or high solids content. It also is frequently used where high pressure or temperatures are involved or as a finishing unit to achieve higher than normal concentrations.

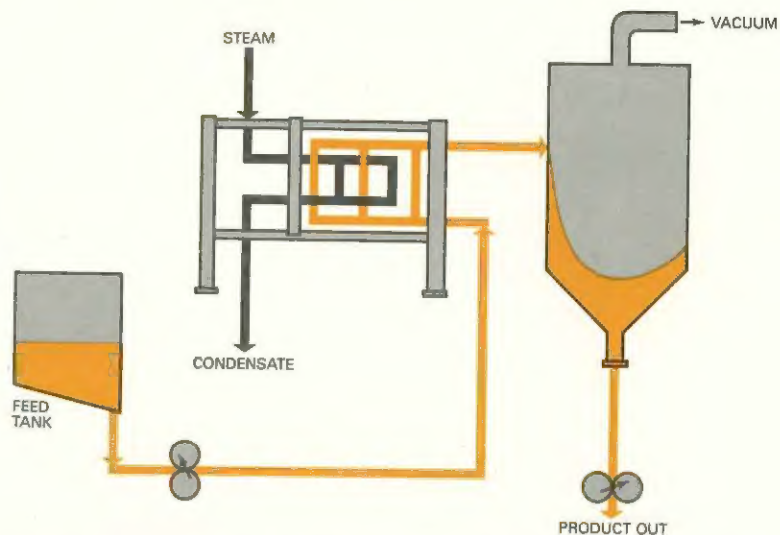
Under normal operation, feed liquor and steam are directed through alternate passages formed by gasketed plates which are more closely spaced than those in an APV plate evaporator. This spacing results in a high turbulent flow with high heat transfer coefficients. On contact with the heated plates, the liquor is vaporized, and the concentrated product and vapor are discharged to the separator. When used as a flash evaporator, the Paravap is fitted with an orifice plate which causes back pressure in the evaporator and prevents vaporization until liquid enters the separator.

### *advantages*

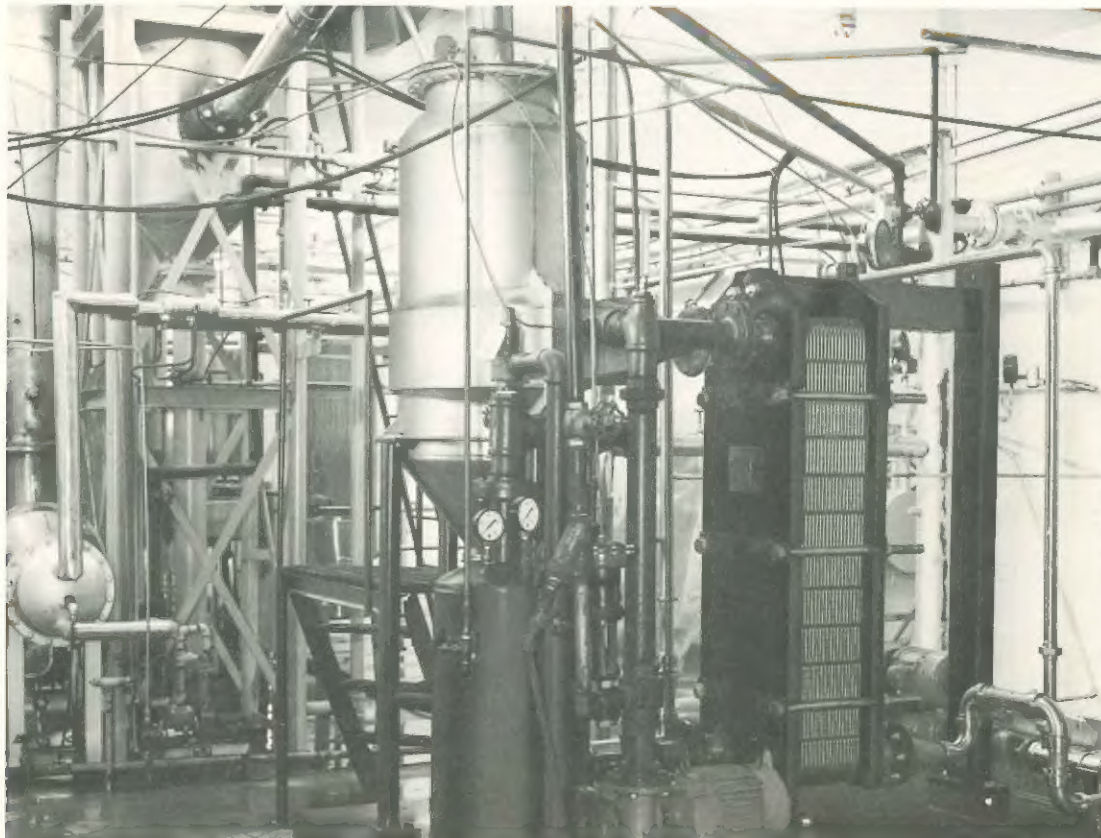
- low residence time protects highly concentrated viscous products from heat damage
- minimum fouling or burn-on
- low capital cost and economical operation
- heat transfer surfaces easily accessible and replaceable
- has no moving parts other than pumps
- in-place circulatory cleaning
- available as compact, packaged plants

### *applications*

For use in concentrating viscous and foaming materials such as soap solutions, pectin, glucose, caustic black liquor effluent, corn steep liquor, and certain juices to high total solids content.

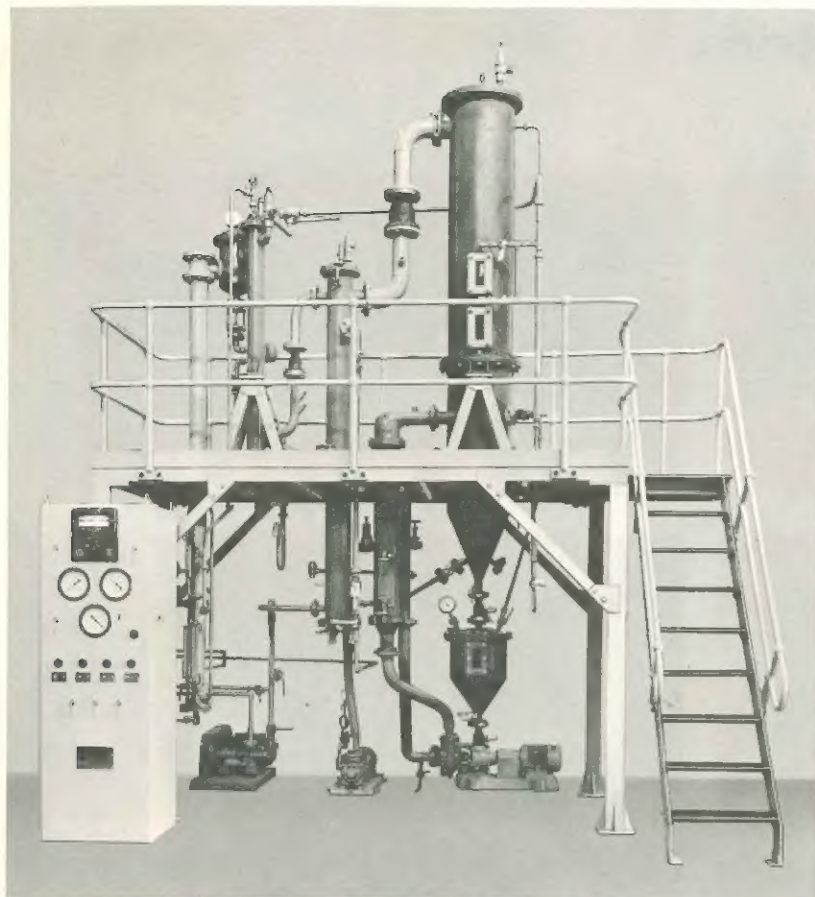


This APV Paravap is used for processing various fruit pulps or as a finishing unit to obtain high solids contents.



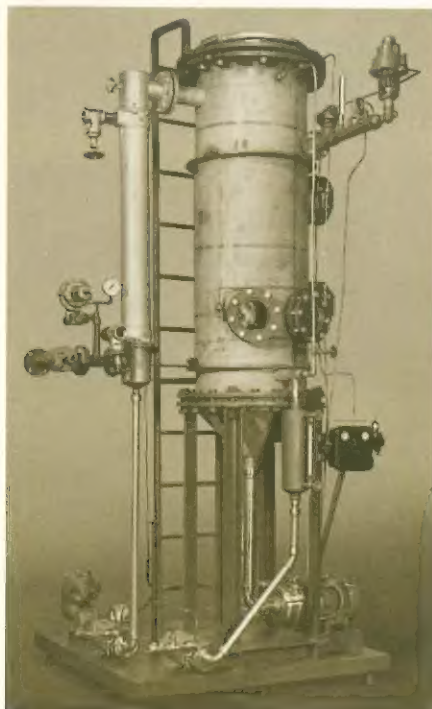


## pilot plant evaporators

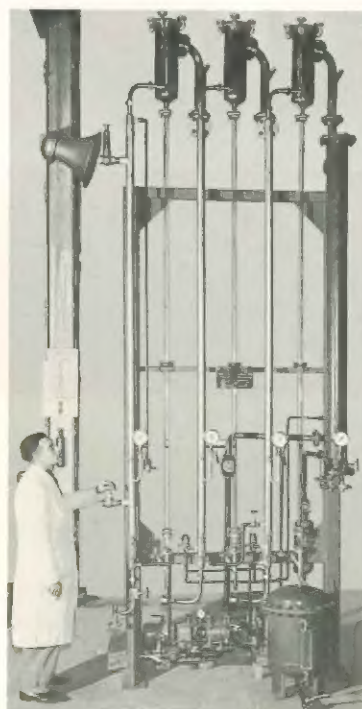


Flexible climbing film and forced circulation double effect pilot plant unit.

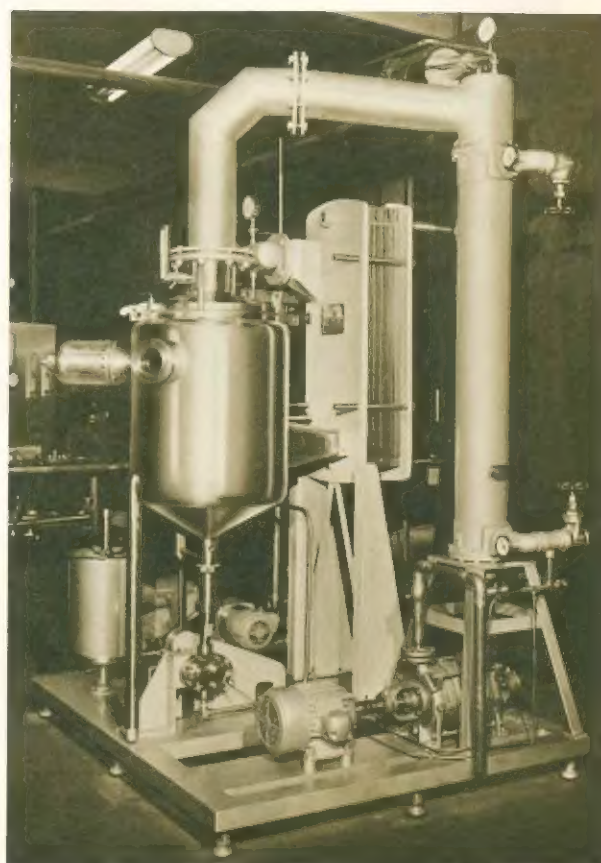
Small scale Rosenblad type evaporator module for research and development duties.



Triple effect climbing film evaporator is ideally suited for experimental laboratory work.



To fill the need for small evaporators suitable for schools, laboratory research or test duties, as finishing stages for high viscosity concentration, or for limited production of specialty products, APV offers a selection of four types of pilot plant units. These are the APV 'Junior' plate evaporator, the APV/Kestner film type units, the APV/Kestner forced circulation evaporator, and the APV/Rosenblad falling film module. Each type incorporates all the features of standard production units described elsewhere in this catalog and differs only in capacity. Each type is available as a compact, packaged evaporator ready for installation and use. For on-site development work purposes, pilot plant evaporators are available on a rental basis.



APV pilot plant 'Junior' plate evaporator can provide 800 lbs/hr maximum evaporation capacity.



## other APV equipment for the process industries

### Paraflow plate heat exchangers

Compact, flexible units for the continuous heating and cooling of heat sensitive or fouling liquids. Provide high heat transfer rates on both thin and viscous materials, high operating pressure capabilities, and minimum holding time to protect product quality. Capacities are easily changed by adding or removing plates of stainless steel or other corrosion-resistant materials. Require minimum floor space and head room.



### deaerators

Compact unit provides maximum deaeration of juices, sauces, purees, and other air sensitive products. Minimizes oxygen content to reduce loss of Vitamin C and prevent product damage. All stainless steel construction eliminates metallic contamination. Available with automatic controls.



### spray dryers

Designed to produce free flowing powders of superior quality in a single step, continuous operation. Provides uniform product with good reconstitution properties. Simple operation, easy cleaning, minimum maintenance. Applicable to heat sensitive products or the drying of bulk chemicals at low production costs.



### essence recovery units

Complete units for the recovery of volatile flavor and aroma essence normally lost in the concentration of fruit juices or the production of jams, jellies, and other food products. Unusual steam economy. Liquid feed. Reduced water requirements. Stainless steel construction protects against product contamination.



### pneumatic dryers

Unique Thermo-Venturi units for economical flash drying of granular and semi-solid food and chemical products. Features rapid drying, controlled contact time, high thermal efficiency, easy cleaning, and minimum space requirements. Low installation, operation and maintenance costs. Also available in 'folded tube' design for use in restricted height areas.



### pumps—valves—fittings

Pumps of 2", 2-1/2" and 3" size are efficient, dependable, and easy to maintain; feature sanitary design with closed impellers and high pressure capabilities. Valves include pneumatic and wide angle types especially designed for sanitary use. No sticking, galling or leaking. Fittings of stainless steel are designed specifically for clean-in-place lines.



### automation and design service

Experienced APV engineers are available for consultation about the automation of production systems or the engineering of complete processing plants and facilities for greater economy and efficiency. Without obligation, recommendations will be made covering the type of equipment or complete systems best suited to your product and production requirements.



## A.P.V. COMPANY, INCORPORATED

137 Arthur Street, Buffalo, N.Y. 14207 • 716-876-8744

A.P.V. (Canada) EQUIPMENT LIMITED • 103 Rivalda Road, Weston, Ontario • 416-742-8250

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